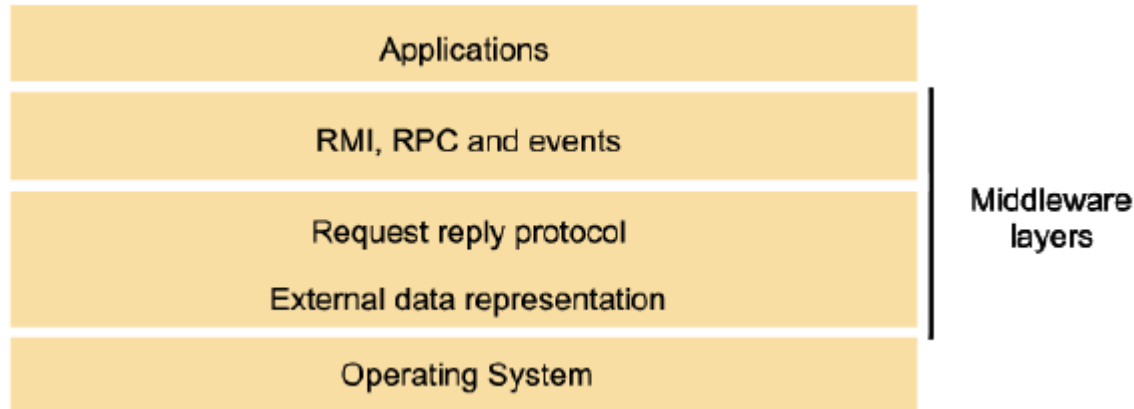


Distributed Systems

COMP90015 2019 Semester 1
Tutorial 05

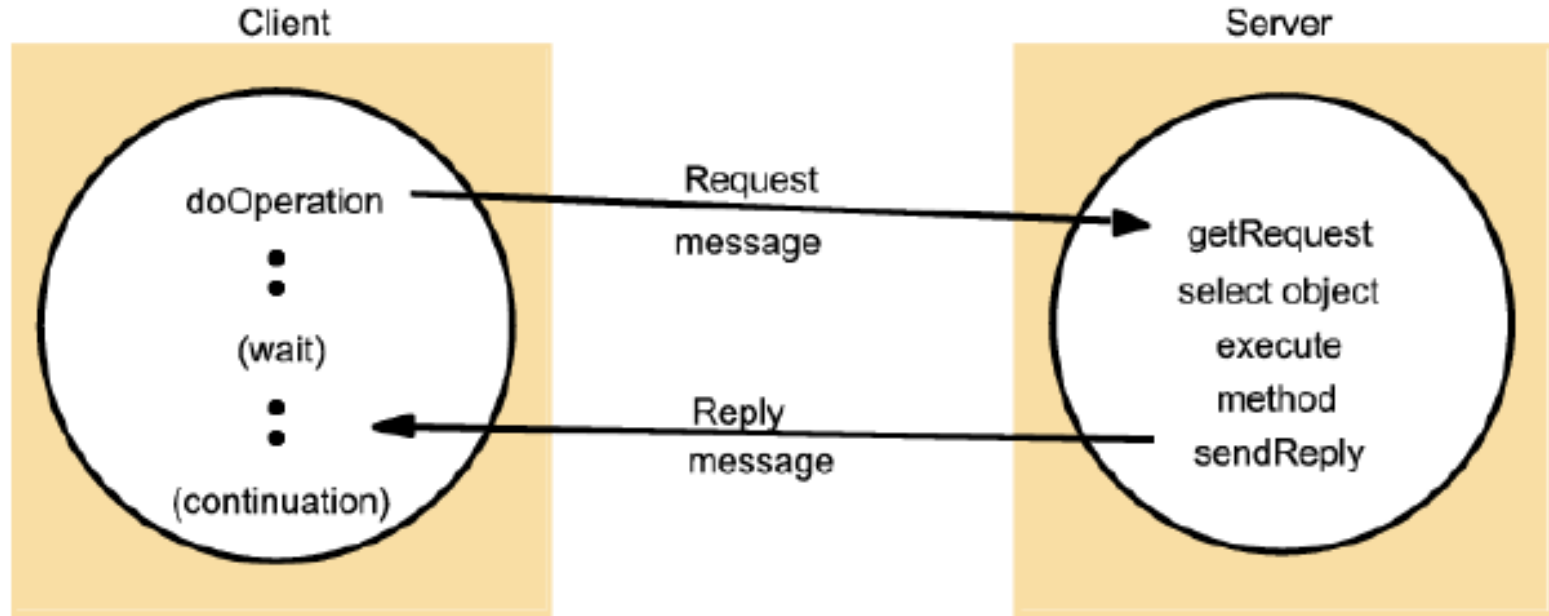
Remote Invocation

- A set of information exchange protocols at the Middleware layer



- Can you define and explain the procedure of the Request-Reply protocol?

Q1: Describe the procedure of the Request-Reply protocol?



Q2: What are the issues that may arise in a request-reply process?

- Request timeouts
 - Retry request message after timeout
 - Do nothing
- Reply timeouts
 - Retransmit results after timeout
 - Do nothing
- Receiving duplicate requests/replies
 - Discard duplicate messages
 - Perform the same action again if the logic is idempotent

Invocation Semantics

- Different issue handling strategies lead to different invocation semantics
- Invocation semantics
 - Define what the client can assume about the execution of the remote procedure
 - Offer different reliability guarantees in terms of the number of times that the remote procedure is executed
- Classification of Request/Reply protocols based on invocation semantics

	Name	Messages sent by		
○ The request protocol (R)		Client	Server	Client
○ The request-reply protocol (RR)	R	Request		
○ The request-reply-acknowledge protocol (RRA)	RR	Request	Reply	
	RRA	Request	Reply	Acknowledge reply

Q3: Can you explain the following invocation semantics?

- *Maybe*
- *At-least-once*
- *At-most-once*

Different Invocation Semantics

- **Maybe:**
 - The remote procedure call may be executed once or not at all.
 - Unless the caller receives a result, it is unknown as to whether the remote procedure was called.
 - Suitable for applications in which occasional failed calls are acceptable
- **At-least-once:**
 - Either the remote procedure was executed at least once, and the caller received a response, or
 - The caller received an exception to indicate the remote procedure was not executed at all.
 - Suitable for idempotent operations.
- **At-most-once:**
 - The remote procedure call was either executed exactly once, in which case the caller received a response, or
 - It was not executed at all and the caller receives an exception.
 - Suitable for non-idempotent operations.

Figure 5.5
Invocation semantics

<i>Fault tolerance measures</i>			<i>Invocation semantics</i>
<i>Retransmit request message</i>	<i>Duplicate filtering</i>	<i>Re-execute procedure or retransmit reply</i>	
No	Not applicable	Not applicable	<i>Maybe</i>
Yes	No	Re-execute procedure	<i>At-least-once</i>
Yes	Yes	Retransmit reply	<i>At-most-once</i>

Article Discussion (Eventual Consistency)

End of Tutorial
